of leaders of thought it is curiously old in form. They give rules for the treatment of signs on the removal of brackets, which we cannot imagine either of them using in actual teaching; we imagine them constantly carrying the boys back to the meaning of the expression under consideration, until the boys have absorbed the rule without ever putting it into words. And the quantity of manipulation: there are tons and tons, enough to wear down the teeth of the most omnivorous boy. All this manipulation cannot be intended for the boy of mathematical ability; he will acquire all necessary manipulative skill on a tenth of it. It cannot be intended for the non-specialist; he does not need such manipulative skill, and if he does acquire it he has no time left for the more human mathematical studies to which he ought to push on.

We are forced to conclude that the book is cast in this form to meet the demand of the market. We have no blame for suiting the book to the demand; on the contrary, we sympathise. Better to publish this book, which is the best on the market though weak in some ways, than an ideal book which no one would use. What we do suggest is that our leaders of thought should write books which meet the demand, and at the same time mark portions of the book for omission whenever circumstances allow it, in order to wean the teacher and examiner from useless studies.

In Mr. Hall's "School Algebra" (3) we find the same excess of manipulative exercises as in Godfrey and Siddons. On the other hand, we hail with delight his plan of using infinite series without proof of their validity. A clear consciousness of the concepts of mathematics is the first desideratum; abstruse proofs are for the few. A little more telescoping of the customary mathematical course and the non-specialist will be able in his school career to attain to the ideas of the calculus.

One desirable piece of telescoping is the omission from the compulsory course of permutations and combinations. They provide, of course, good mental gymnastic. As regards progress in knowledge, they lead up to the binomial theorem; so that they cease to be necessary in a course which assumes the validity of that theorem. At the same time, their discussion gives rise to many elegant theorems, and it is therefore well to leave them available for the leisure hour of the boy who fancies them.

Messrs. Hall and Stevens' "Examples in Arithmetic" (4) includes the treatment of stocks and shares. No doubt examination requirements necessitate their inclusion, but we should be glad to see their omission recommended for schools the circumstances of which allow it. The difficulties lie in the terminology and in the pupil's ignorance of the transactions involved; there are no arithmetical difficulties. Again, continued fractions, which at an earlier time provided the only means of obtaining approximations to complicated quantities such as surds, are now superseded by decimals, and might with advantage disappear from books on arithmetic.

The pruning away of unnecessary excrescences from the school course makes possible the inclusion of the infinitesimal calculus, which is more and more coming to be recognised as a regular school subject, and we welcome Mr. Baker's little book (5) as helping towards that desirable consummation. Mr. Baker no doubt caters for the boy who will need the calculus as part of his technical equipment in later life, and for that boy he rightly provides logical proofs of all theorems. In course of time the non-specialist boy will study the calculus in place of stocks and shares, permutations and combinations, and such things; and this boy should have a book on the lines suggested by Mr. Newbold in his little paper on "Higher Mathematics for the Classical Sixth Form," in which the ideas of the subject are evolved from the discussion of interesting everyday problems.

THEORETICAL AND APPLIED PHYSICS.

(1) *Heat and the Principles of Thermodynamics.* By Dr. Charles H. Draper. New and revised edition. Pp. xv+428. (London: Blackie and Son, Ltd., 1911.) Price 5*s*. net.

(2) *Laboratory Problems in Physics.* To accompany Crew and Jones's "Elements of Physics." By F. T. Jones and Prof. R. R. Tatnall. Pp. ix+81. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1912.) Price 2*s*. 6*d*.

(3) *Outlines of Applied Optics.* By P. G. Nutting. (Blakiston's Science Series.) Pp. ix+234. (Philadelphia: P. Blakiston's Son and Co., 1912.) Price 2 dollars net.

(4) *Elements of Hydrostatics.* With numerous examples. For the use of schools and colleges. By George W. Parker. Pp. viii+150. (London: Longmans, Green and Co., 1912.) Price 2*s*. 6*d*.

(5) *Junior Heat.* By Dr. John Satterly. Pp. viii+184. (London: W. B. Clive, University Tutorial Press, Ltd., 1912.) Price 2*s*.

(1) IT is refreshing to find, occasionally, an elementary text-book in which the author has been bold enough to depart from the stereotyped mode of treatment and introduce new features. Such is the case with the second edition of Dr. Draper's book. The author's intention, as expressed in the preface, of revising the book

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in the light of new methods of investigation, has been very successfully carried out in the first part, which deals with the experimental side of heat. While the fundamental treatment of the subject has not been neglected, special attention has also been directed to comparatively recent work. The chapters on the various methods of measuring temperature and that on the liquefaction of gases are both excellent, and will greatly add to the usefulness of the text-book. The second part is devoted to the consideration of the principles of thermodynamics, which, for the most part, are expressed clearly and in a simple manner. Several important applications of the principles are shown, and a large number of numerical examples, both in this and the first part of the book, are given.

There is, however, a rather serious misstatement in connection with the meaning of the second law. After stating this law in the form due to Clausius, viz. "It is impossible for a self-acting machine, unassisted by any external agency, to convey heat from a colder to a warmer body," the author at a later stage makes the statement, "It must be remembered that this law applies only to engines working in reversible cycles and to reversible cyclic processes." This undoubtedly suggests that a self-acting engine performing an irreversible cycle *may* convey heat up temperature. In fact, all actual self-acting engines *do* perform irreversible cycles of operations, and surely they are not to be regarded as cases of violation of the second law. What is probably meant by the above unfortunate statement is that *cyclic* processes only must be considered. With regard to the scope of the book, the standard is about that required for pass degree examinations, and the elementary use of the calculus has very properly been adopted.

(2) In writing this book the authors have added another to the already numerous works of this kind. In many respects it is similar to others previously reviewed in these pages. Instructions for the performance of a large number of experiments in the various sections of physics are given, each description being accompanied by a few questions bearing on the experiment. Some of the questions seem rather unnecessary. In the experiment on the simple pendulum, for instance, the student is supposed to have discovered that T varies as $\sqrt{l}$, and is then asked if T varies as $\frac{l}{\sqrt{g}}$, which is quite obviously contradictory to his previous discovery. Again, he is told that $T=2\pi\sqrt{\frac{l}{g}}$, and is asked if g can be computed provided T and l are known. The experiments on the spectrum are unsatisfactory. The student is supposed to be able to distinguish between continuous and line spectra, using a slit $\frac{1}{8}$ in. wide and *no lens system.*

(3) This book is quite an unusual one, and deals with a most interesting subject. It is primarily designed for those who contemplate taking up work in the varied fields of lens design, illuminating engineering, colorimetry, photography, radiometry, pyrometry, etc. A training in theoretical optics is assumed, and only those possessing this will thoroughly appreciate the book in all its detail. A great deal of information is compressed into a small volume, and the suddenness with which the subjects change on this account is rather embarrassing to the reader. This is particularly the case with the introduction, where a general description of the results of investigations in light is crowded into twenty-five pages. Nevertheless the book is a considerable step forward, and may be regarded as a sort of forerunner to a more pretentious treatise, which the author hopes will presently be produced.

(4) This is a class-book upon the same lines as the author's "Elements of Mechanics." It treats in quite an elementary fashion of the fundamental principles of the statics of liquids and gases. Applications to the determinations of specific gravities are given, and various forms of apparatus depending on the principles are described. Numerous examples, taken from university examination papers, are appended to the chapters.

(5) This book is also quite elementary in character, and includes all that is required for the Junior Local Examinations. The author claims to discourage the use of mathematical formulæ, yet they appear to occur quite as frequently in this book as in others of the same type. It is true, however, that many numerical examples of the application of the formulæ are given.

FOOD AND HYGIENE.

(1) *The Science of Hygiene.* A Text-book of Laboratory Practice for Public Health Students. By Walter C. C. Pakes. New edition, revised by Dr. A. T. Nankivell. Pp. xi+164. (London: Methuen and Co., Ltd., 1912.) Price 5*s.* net.

(2) *Text-book of Hygiene for Teachers.* By Dr. R. A. Lyster. Pp. viii+496. (London: W. B. Clive, University Tutorial Press, Ltd., 1912.) Price 4*s.* 6*d.*

(3) *Experimental Domestic Science.* By R. Henry Jones. (Heinemann's Science Manuals.) Pp. ix+235. (London: W. Heinemann, 1912.) Price 2*s.* 6*d.*

(1) THIS book consists of the chemical and microscopical sections of the 1900 edition, revised and extended. It is intended for

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